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(54) Formation of laminates.

(57) A unique laminate suitable for formation into packages for the microwave heating of foodstuffs is provided. Metallized polymeric film is selectively demetallized to provide discrete metallized regions, the patterned film is laminated with outer stabilizing layers, for example, paper, and the laminate formed into a package. When used for heating a foodstuff, the discrete metallized region is located adjacent the foodstuff and on the opposite side of the foodstuff from the source of microwave energy. The metallized region results in conduction heat being applied to the foodstuff as well as microwave heating.

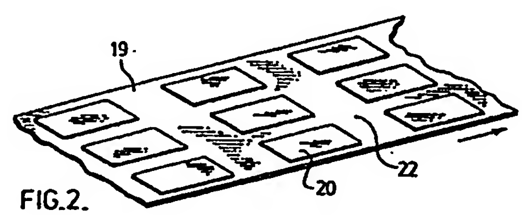

FIG.2.

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Croydon Printing Company Ltd.

FORMATION OF LAMINATES

The present invention relates to the formation of laminates, in particular for use in packages for microwave cooking.

The microwave cooking of foods provided in bag-like enclosures is known. It is sometimes desirable to provide a metallized region adjacent the food to increase the concentration of energy and provide a more rapid cooking cycle. These currently lack any convenient manner of readily providing such structure.

In accordance with the present invention, there is provided a laminate suitable for formation into packages, wherein at least one layer of metallized flexible polymeric material which has been demetallized to provide at least one discrete metallized area on one surface thereof with the remainder of the surface demetallized and at least one layer of other material.

The discrete metallized area is located on the polymeric material sheet so as to be positioned in the localized region of the foodstuff, when the laminate is formed into an enclosure housing the same, but not elsewhere, for the purpose of cooking by the application of microwave energy.

Preferably, the laminate is provided by a metallized flexible polymeric material layer sandwiched between two relatively-stiff paper layers.

By providing a flexible polymeric sheet having discrete metallized regions on one surface thereof, lamination with additional layers to provide stability and strength is readily achieved by conventional in-line laminating operations.

The present invention also provides a method of cooking by the application of microwave energy, which comprises enclosing a microwavable foodstuff in a package which is constructed at least in part of a

flexible polymeric film having a discrete metallized region adjacent the foodstuff, and applying microwave energy to the package and the foodstuff therein while the metallized region is located on the opposite side of the foodstuff from the source of microwave energy.

One convenient foodstuff which may be formed by the present invention is popcorn. Popping corn and butter are positioned in the package which is folded generally flat but which has a sufficient volume to accommodate the corn when popped.

In the present invention, there is employed a polymeric material film which has discrete metallized regions on one surface. This film may be formed by selective demetallization of a metallized polymeric film.

The substrate polymer film may be any convenient flexible polymeric material chemically resistant to the etchant and typically is a polyester material, for example, that sold under the trade mark "Mylar". The polymer material usually is transparent but may be translucent.

The metal film adhered to the polymer film may be any convenient metal which can be removed from the surface of the substrate by chemical etching. The metal usually is aluminum, but other etchable metals, such as copper, may be used. The thickness of the metal film may vary widely within the range of about 10 to about 1000 A, preferably about 300 to about 600 A, and may vary in appearance from opaque to transparent. In the case of aluminum, the chemical etchant commonly is aqueous sodium hydroxide solution.

Selective demetallization of metallized polymeric films may be effected on a continuous basis on a web of metallized polymeric material, as described, for example, in my U.S. Patents Nos. 4,398,994 and 4,552,614 and in my pending United States patent applications No. 723,909 filed April 16, 1985.

As set forth therein, a pattern of demetallized regions may be formed on the web by a variety of techniques which involve etching of predetermined regions of the web using, for example, an aqueous etchant to remove the metal from those regions while leaving the remainder of the metal surface unaffected.

The continuous procedures described in my prior patent and applications enable the desired metallized regions to be provided on the polymeric material web rapidly and readily. The patterned web that results from the selective demetallization is in a convenient form for lamination with other materials to form the packaging laminate. The lamination operation may be effected using conventional laminating techniques. The lamination operation may be effected in-line with the demetallizing step or may be effected in a separate operation on a reel of selectively demetallized polymeric material. The laminate, therefore, may be easily and readily formed using existing laminating techniques and equipment.

Lamination of the selectively demetallized polymeric film is required in order to prevent distortion and deformation in the metallized region upon the application of microwave energy. For this reason, the layer or layers to which the polymeric film is laminated should be relatively stiff, such as to resist deformation and distortion during the application of microwave energy. Usually, the selectively demetallized polymeric film is sandwiched between two other layers, but for some uses lamination with a single other layer is possible.

The layer or layers to which the demetallized patterned film is laminated may be another polymeric film, a paper sheet or any other convenient packaging material. The laminate may be formed into packages for use in the microwave heating of foodstuffs by any

convenient technique, depending on the intended use of the package.

The laminate is shaped into the packaging structure so that the metallized region usually provides part or all of one surface of the package on which the foodstuff is to rest for cooking. Microwave energy then is applied to an opposite surface of the package, so that the microwave energy, in addition to heating the foodstuff in conventional manner, also heats the foodstuff by reason of concentration of the microwave energy in the metal layer, thereby heating up the metal layer, and heating of foodstuff by conduction from the heated metal layer. In this way, the foodstuff is rapidly heated.

The package structure provided in accordance with this invention is useful for a wide variety of food products, especially where conduction heat is desirable. As mentioned above, one application is in the formation of popcorn by microwave heating of popping corn located in the package. Other applications are in the reconstitution and/or cooking of frozen food products where a crisping or browning effect is desirable, for example, in the reconstitution of frozen french fries and frozen pizzas.

The amount of microwave energy which is converted into conduction heat by the utilization of a discrete metallized region or regions on the polymeric film may be varied by varying the area of the metallized region through variation of the demetallization procedure. It is also appreciated that the density of the deposited metal should be controlled. The density of the deposited metal in the remaining metallized area is such to avoid overheating or burning of the package and product during the microwave heating.

The invention is described, by way of illustration, with reference to the accompanying drawings, in which:

Figure 1 is a schematic representation of the package-forming operations provided in accordance with one embodiment of the invention;

Figure 2 is a perspective view of a web of polymeric material illustrating the presence of discrete metallized regions;

Figure 3 is a perspective view, with parts cut away for clarity, of a package structure containing a foodstuff, provided in accordance with one embodiment of the invention; and

Figures 4A and 4B are detailed sectional views taken at lines A-A and B-B respectively.

Referring to Figure 1, there is illustrated therein a packaging line 10 comprising a demetallizing station 12, a laminating station 14 and a packaging station 16. While the stations 12, 14 and 16 are illustrated as being in-line, the stations may effect discrete operations or two of the stations may be operated in-line, as desired.

A web of metallized polymeric material is fed by line 18 to the demetallizing station wherein the web is subjected to selected demetallization to remove the metal from desired regions of the metallized surface of the web and leave other discrete metallized regions unaffected.

As may be seen in Figure 2, a pattern of rectangular metallized regions 20 may be provided with the intervening areas 22 free from metallization. Any desired pattern consistent with the desired end use and dimensions of the web 19 may be employed.

Selective demetallizing of the web 19 may be effected in any convenient manner to form the desired pattern of metallized 20 and demetallized 22 regions on the web, for example, any of the procedures described in my aforementioned U.S. patent and pending applications.

Following demetallizing, the web 19 is fed by line 24 to a laminating station 14 where the demetallized web 19 is laminated with a pair of paper webs 26 and 28. Any convenient in-line laminating technique may be employed. The paper used to provide the webs 26 and 28 may be of any desired form, usually is stiff relative to the polymeric web 19 but still sufficiently flexible to permit ready formation of the resulting laminate into a packaging material.

The laminate of the polymeric material web 19 sandwiched between the paper webs 26 and 28 is forwarded by line 30 to a forming station 16 wherein the laminate is formed into a package of desired shape by conventional forming techniques. The package is removed by line 32.

In Figures 3 and 4, there is illustrated a typical package construction provided in this invention. As seen therein, a package structure 50 is formed from a laminate of outer layers 52 and 54 and a polymeric material layer 56 which has a discrete metallized region 58 provided in the bottom wall 60 of the package.

The package structure 50 encloses a foodstuff 62 for heating by microwave energy 64 applied through the top wall 66 of the package 50. The microwave energy 64 passes through the top wall 66 since there is no metallized region, as a result of demetallizing of the polymeric film 56. The microwave energy 64 heats the foodstuff 62 by the usual mechanism but also the presence of the metallized region 58 causes the foodstuff to be heated also by conduction therefrom.

The present invention enables improved microwave cooking procedures to be adopted for certain foodstuffs and further permits in-line techniques to be employed in the formation of packages for use therein.

In summary of this disclosure, the present invention provides novel laminates, novel laminating

procedures and a novel microwave heating procedure based on selectively demetallized polymeric material webs. Modifications are possible within the scope of this invention.

CLAIMS

1. A laminate, characterized by a layer of metallized flexible polymeric material which has been demetallized to provide at least one discrete metallized region on one surface thereof with the remainder of the surface demetallized, and at least one layer of other material.

2. The laminate claimed in claim 1, characterized in that the polymeric material layer is sandwiched between two outer layers of the other material.

3. The laminate claimed in claim 1 or 2, characterized in that the other material is relatively-stiff paper, rigid card or flexible polymeric material.

4. The laminate claimed in any one of claims 1 to 3, characterized in that the flexible polymeric material layer is formed by selective demetallization of a web of such material.

5. The laminate claimed in any one of claims 1 to 4, characterized by being formed into a foodstuff container for heating by the application of microwave energy.

6. A method of forming a laminate for use in packaging, characterized by feeding a web of flexible metallized polymeric material through a demetallizing station wherein the metal is removed from selected portions of the metallized surface of the web to leave discrete longitudinally-spaced metallized regions along the length of the web, and passing the demetallized web through a laminating station wherein the demetallized web is laminated with at least one web of flexible material to form a laminate suitable for formation of package therefrom.

7. The method claimed in claim 6, characterized in that the laminate is passed through a forming station wherein the laminate is formed into a packaging material suitable for heating food by microwave energy.

8. A method of cooking by the application of microwave energy, characterized by enclosing a foodstuff capable of being heated by microwave energy in a package which is constructed at least in part of a flexible polymeric film having a discrete metallized region adjacent the foodstuff, and applying microwave energy to the package and the foodstuff therein while the discrete metallized region is located on the opposite side of the foodstuff from the source of the microwave energy.

9. The method claimed in claim 8, characterized in that the flexible polymeric film is provided by selective demetallization of a metallized polymeric film and the flexible polymeric film is employed in the form of a laminate with two outer relatively-stiff paper layers in the package.

10. The method claimed in claim 8 or 9, characterized in that the foodstuff comprises popping corn and the package has a sufficient volume to accommodate the corn when popped by the application of the microwave energy.

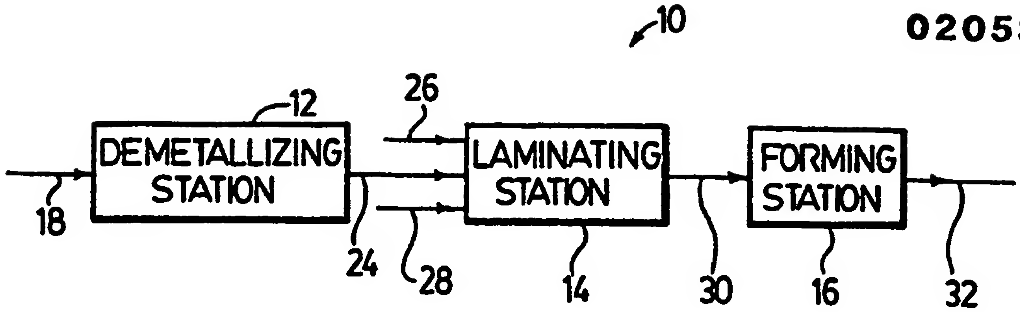

FIG.1.

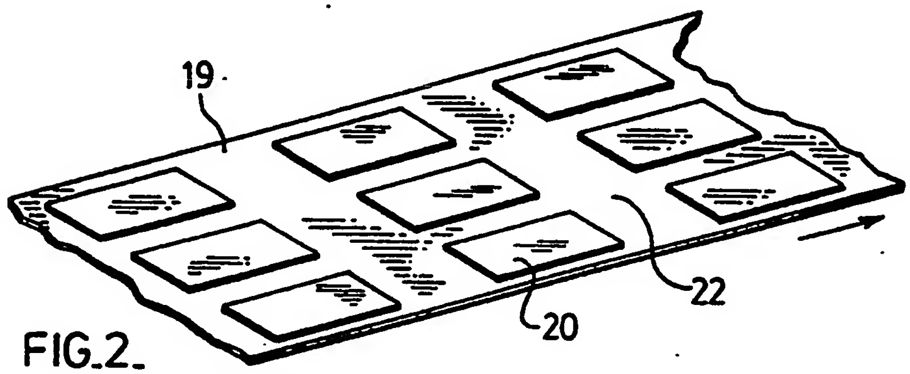

FIG.2.

FIG. 3.

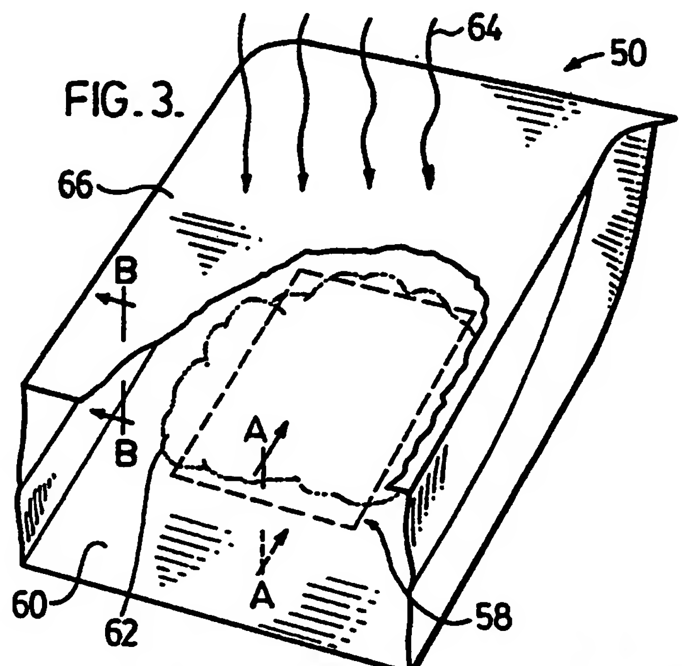

FIG.4A.

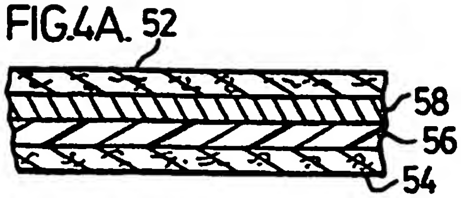

FIG.4B.